"Are animals technology?" – archive of messages posted on Envirotech, Envirotech@lists.Stanford.EDU, 2001.

Fri, 20 Jul 2001 17:34:15 -0700
From: Edmund Russell Russell@virginia.edu

Dear Colleagues,

Are animals technology? If so, what might they tell us about the history of technology? And about the overlap between history of technology and environmental history?

I'm at an early stage of researching a book on dogs and dog breeding and welcome ideas on the framework for this study. I'm thinking of this project as a case study of the impact of humans on the evolution of other species. It's easy to see how this project belongs in environmental history (though domestication and evolution are both vastly understudied aspect of environmental history). But conversations with historians of technology have shown that, for some, it's not obvious how dogs are technology or how studying them would address issues of concern to historians of technology. I'm not interested in the technological accoutrements of dogdom (collars, kennels, food, etc.). I'm interested in the dogs (and their genes) themselves. I've developed some ideas but would welcome a conversation.

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Sat, 21 Jul 2001 08:18:51 -0700 (Pacific Daylight Time)
From: David Kirsch dkirsch@anderson.ucla.edu

Ed,

This sounds promising. The canonical case for an animal as technology is the horse, of course. I think immediately of Lynn White, Jr.'s famous story of the diffusion of the stirruped warhorse in _Medieval Technology and Social Change_. The use of horses in agriculture, in milling and in transportation has provided terminology like horsepower that we still use today to describe entirely mechanical technologies.

There are a few pages in my electric vehicle book on urban horses at the turn of the 20th century. I have an article with Gijs Mom in the July T&C that also goes into some of the coevolved aspects of horses and human technology, again in the context of the history of the commercial vehicle. Horses and humans worked together as a team in many delivery applications: the team would know from experience where the next stop was supposed to be and would proceed from one stop to the next without the driver's active presence.

I am not sure if Gijs and/or Clay McShane are on the envirotech list, but I would contact them, as well as Joel Tarr. I believe that Joel and Clay are working on a book about the urban horse ("Gelded Age America" or some such). They would doubtless be able to point you to sources on, for instance, livery stable management, trade literature, horse markets, etc. All of these aspects would certainly be relevant to a study of dogs as technology too.

On the subject of horse breeding, you might contact Phillip Thurtle at the University of Washington. Phil was working on horse breeding at the Stanford farm and its connections with the breeding and training of humans at the newly established university.

I hope this helps get the ball rolling, both for you and here on envirotech.

See you soon,

David K.

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Sat, 21 Jul 2001 10:45:01 -0700
From: jcw1 jcw1@gateway.net

Ed,

    This sounds fascinating; yet simply asking the question "are animals technology?" is bound to startle most people. In a way it asks for a rethinking of generally accepted views of the definition of technology. I'm not surprised historians of technology don't easily accept the premise that dogs are technology. But I am surprised that they don't see how studying dogs would address issues of concern to them, and David Kirsch points out some good starting points with his suggestions about the horse.

    I like your idea of tracing the impact of humans on the evolution of other species through the case study of the dog. I know little of "genetic technology" but clearly breeding of animals fits into this, and I'm reminded of a paper at the technology and environment session in ICOHTEC in Belfort, France in 1999, by Eberhard Wolff entitled "Animals, vaccines, and human relationships with nature." And, of course, our use of dogs as tools for hunting, herding, working on treadmills, and so many other activities, is a way in which we really should see dogs as technology.

Cheers,

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Sun, 22 Jul 2001 09:29:05 -0700
From: JLangrish@AOL.com

It all depends on what you mean by......
By technology I mean A WAY OF DOING SOMETHING that improves on naked human
capabilities. So transport technology is ways of getting from A to B that are 'better' than walking
or running. The nature of 'betterness' is crucial. This means that most technology is systems
not things. Railway technology includes timetables, safety systems, suspension systems etc.
Most early technologies included animals as their POWER SOURCE. When I was young, the
railway system in England still used horse drawn carts for short distance transport to and from
railway stations. The ox as power source helped transform the world. There are of course many
many other ways in which technological systems incorporated animals OR attempted to COPY
animals – i.e. role of animals as source of design in technology. It would take a book to go
through even part of the story. Why a DOG for the case study????

JLangrish@AOL.com
Prof John Langrish, Design and Technology Group, University of Salford, UK

Sun, 22 Jul 2001 09:29:07 -0700
From: Dann Sklarew, Ph.D. [mailto:dann@sklarew.com]

Before going directly to canines, I think you could make a strong case for horses and oxen being
[used as] technology over the years. On the other hand, if you view our millennia of
eugenic/selective breeding activities for food as an engineering (technological innovation)
process of sorts, then I think you might call all human domesticates (animal, plant, fungal and
microbial) [used as] "technology." (So, where does that leave human stem cells?)

Taking this argument further, selective landscaping (e.g. irrigation, fumigation, weeding and
ornamental gardens of nonindigenous species, artificial ponds and lakes, farms and croplands,
soccer fields and city parks) often involves artificial selection of some species over others
towards human ends and/or coopting what living beings do to survive in order to serve human
purposes. On the scale of transforming whole ecoregions (e.g., the USA's Great Plains farmland,
West Virginian mountain tops being lopped off for mining purposes, or a million trees currently
being planted in India), I would say these technological activities have a great impact on
environmental history.

Back to dogs, it seems that centuries of British fox hunters would agree that their hunting dogs
are a sort of technology, while fox hunting opponents argue vehemently that in this sport, the
dogs had a significant impact on foxes and their place in the local environment.

Dann Sklarew

Sun, 22 Jul 2001 11:02:21 -0700
From: Teresa Sabol Spezio [mailto:tsspezio@darkwing.uoregon.edu]

Greetings

In February, Donna Haraway came to the UofO and gave a talk on "companion species" which
was all about dogs and dog breeding and evolution. Thetitle was "From Cyborgs to Companion
Species: Kinship in Technoscience" I think a copy of it is available thru the UofO. It seemed to

me she was also working on a book about this same issue. Her talk was fairly unformed but it may be helpful.

Teresa

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Mon, 23 Jul 2001 08:23:52 -0700
From: Paul Kirby [mailto:pjk23@hermes.cam.ac.uk]

Dear All

This post has been delayed by gremlins but I thought I would re--post it anyway.

As a member of a list dealing with "enviro-ethics" I can imagine a hostile reaction to the idea of animals as technology if those reacting see it as evidence of using animals as means. Rightly or wrongly however animals have been (and are) used as animate tools. Working dogs for example, (whether sheep dogs, guard dogs, tracker dogs, retrievers) are tools in that they extend the human capacity to act. If we accept working animals as tools then we must surely accept them as part of technology.

If we follow the line of reasoning that suggests that technology existed before scientific understanding (although in the present day most technology is based in science) then animals might be included amongst the natural phenomena that were harnessed by the early technologists, like the wind, fire and running water.

If we "improve" the tools, in the case of animals by selective breeding, then this is as much an act of technology as is shaping stone.

I have found "Thinking Through Technology, The Path between Engineering and Philosophy" by Carl Mitcham (Chicago) quite useful in exploring ideas of technology.

Regards Paul K

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Mon, 23 Jul 2001 10:33:05 -0700
From: Hugh Gorman hsgorman@mtu.edu

Ed's question about "are animals technology" reminded me of an article I saw in Invention and Technology (the GM-sponsored magazine with non-academic articles having to do with the hist. of technology).

The article described specialized companies trucking honeybees around in large trailer trucks to agricultural areas that need the bees to pollinate certain crops. (I have no idea which crops.) I guess they put out the beehives for a while, then collected them and put them back in the truck, and moved on.

Now, in my mind, those bees are certainly part of a larger technological system to produce crops. Whatever breeding system is used to produce bees most suited for the task is also a technology. But are the bees themselves "a technology?" I'm not entirely sure what that question means, but the degree to which beekeepers start doing quality control on bees and develop methods/standards for defining a "good" bee from a "bad" bee certainly makes those bees look like more of a technology. In general, to the extent that human measurements replace a "natural" or non-directed selection environment, the entities being manipulated start looking more like a technology to me.

The technology of using activated sludge in waste treatment plants also comes to mind. (They are not animals but I think the point is the same). Certainly, the system of using activated sludge to digest organic compounds in wastewater is a technology, but are the microbes a "technology?" Here, I think the answer depends on the extent to which sludge engineers define microbe characteristics that they can measure and then go about influencing the selection process to produce more microbes with those qualities.

Regardless of how one answers the specific question "are animals technology", I think examining the co-evolution of animals with human systems is an important aspect of studying human interactions with the environment, including the interaction between technological systems and ecological systems.

--Hugh

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Mon, 23 Jul 2001 15:23:21 -0400
From: "John Staudenmaier" staudejm@udmercy.edu

Hi,

      William Boyd's "Industrial Chicken: Science, Technology, and the Industrialization of American Poultry Production" comes out in the October issue. It's a first rate piece of research and interpretation and deals with these questions -- what's an animal? etc.

      About dogs it occurs to me that some of the tribes living in what is now the U.S. used dogs as beasts of burden before horses got here from Europe. The Lakota language names a horse "sunka wakan." Sunka means dog and "wakan" means sacred or mysterious or godly (as in "wakan tanka" the great sacred, the principle term for God).   So dogs were technologized to that extent. Some plains tribes also prepared dog as a sacred food, prepared according to ritual, and still do on some sacred occasions. But I've not heard of dog breeding programs.

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Mon, 23 Jul 2001 19:20:17 -0700
From: Jan Wegner [mailto:janice.wegner@jcu.edu.au]

There seems to be a problem with simply defining animals as technology - because animals use humans as a technology too (for providing shelter, food, companionship, protection etc.) Also, if we can define animals as technology, then shouldn't we also define people as the same? - to a factory owner, the workers selected and trained to work in that factory could be seen as part of the technology of production. Humans certainly spend a lot of time training other humans, just as we train animals - whether we've also put the same effort into breeding more suitable humans is another debate again! In other words, animals and humans are in interdependent (though unequal) relationships - is it those relationships that form the "technology"?

Regards
Jan Wegner
History
James Cook University

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Mon, 23 Jul 2001 19:20:18 -0700
From: joel tarr [mailto:jt03@andrew.cmu.edu]

A reply to Ed Russell's query:

Because we have been preparing a book dealing with horses and the city from about 1820-1920, we thought we might offer some thoughts in reply to Ed Russell's query about animals and technology.   It appears to us that to the extent that any energy source can be thought of as a "technology," than animals that are used for purposes of "work" become an essential appendage to the machine. Just as the characteristics of the animal affected the form of the machine, the characteristics of the machine and the needs for its outputs could affect the animal.

Perhaps the most obvious example is the manner in which mechanical techniques were used to increase the size of horses, probably increasing their weight by fifty per cent, between 1850 and 1900. Better breeding (especially the import of European horses, but also artificial insemination) and better feeding (the result of controlled experiments) were the primary reasons. The most valued horses were those that "produced the most work for the least food." Street railway owners kept careful depreciation accounts, limiting horses to five hours a day and five years of heavy service. Robert Thurston, the first president of the ASME and steam engine designer, wrote a book defining the horse as an "animal machine," and explicitly comparing its characteristics to other prime movers like horses and steam engines. The "new horse" was good enough to win the competition for urban heavy hauling from the steam engine at exactly the same time that the latter was displacing it for stationary purposes.

On the more biological side, particular drivers were assigned particular horses, gave names to horses, and had the responsibility for grooming them, a form of bonding in nature.   City horses were almost always geldings--it was easier to get them to focus their herding instincts on humans). All were forms of control. Horses were valued for their looks (funeral homes wanted entirely black animals), their "intelligence" (i.e. ease of training), and "courage" (i.e. willingness to stand the strange sounds of the big city). Old traditions did creep in. The leading American advocate of artificial insemination believed that insemination on Sunday was a bad idea for example. While it was acceptable to recycle an old street railway horse to pull cabs and to use the hide, hair and hooves of dead horses for various purposes, it was only rarely acceptable to recycle them into human food.

Still there is no doubt that they were almost exclusively valued for their work ability (hauling power, durability and low fuel costs) and the process of improving them in each area was exactly akin to refinements in more traditionally defined machinery. As Robert Bakewell, the

great eighteenth century British agricultural reformer noted, he "sought to discover the animal, which was the best machine for turning food into money."

On the evolutionary discussion, Jared Diamond's arguments in Guns, Germs, and Steel: The Fates of Human Societies (N.Y: W.W. Norton, 1997) are worth noting. Diamond points out that the original North American horse, like most large terrestrial animals that were never domesticated, became extinct, while its domesticated Eurasian counterpart survived.

We'd argue that the horse survives today, although in greatly diminished numbers (we doubt that more than a hundred to two hundred horses roam Manhattan, once the habitat of 120,000), because its been genetically manipulated for docility and cuteness thus surviving as a status object, not a practical device (or technology).

Clay McShane and Joel A. Tarr

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Tue, 24 Jul 2001 08:02:49 -0700
From: Reuss, Martin A HQ02 [mailto:Martin.A.Reuss@HQ02.USACE.ARMY.MIL]

My friend Ed Russell has asked a thought-provoking question dealing with animals as technology. I have not had time to read all the responses, but, after some cogitation, wish to add my own thoughts.

At first, I thought Ed had lost his marbles with his question, then I realized how profound it is in many ways. Now that I have thought about it some more, my reservations return.

My fundamental point is this--we cannot confuse technological artifact with technological evidence. Doctored cattle, gene-altered dogs, stirruped horses, cloned sheep, etc. are all evidence of some technological application. The technology (and science in some cases) is in the particular application used, whether mechanical or not. True, this "evidence", like technology itself, extends our control over nature, but let me offer an analogy to make my point clear. Leveed rivers also extend our control over nature by offering flood protection and/or reliable navigation channels. But the technology is NOT the leveed river but the levees themselves and whatever technology was involved in their construction. Similarly, controlled fire extends our control over nature; uncontrolled fire diminishes it. Whatever artifacts we use to control fire forms the technology of fire, and, while controlled fires extend our power over nature, they are not technology but the result of it. Now what do fire, floods, dogs, horses, and mice have in common? The answer is obvious; they are natural phenomena. And how we control natural phenomena defines to a large extent both our technology and our humanity.

I hope these observations provoke some comment and help us realize that my two cats are not technology but certainly have been affected by it.

Marty Reuss

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Tue, 24 Jul 2001 08:49:51 -0700
From: joel tarr [mailto:jt03@andrew.cmu.edu]

Marty Reuss's comment is interesting but it overlooks the numerous attempts by experts such as Thurston to define the animal (including humans) as a "machine." (See, also, David F. Cannell, "The Vital Machine: A Study of Technology and Organic Life") What do we say about Richard White's attempt to define the Columbia River as an "organic machine." White calls the river "an energy system which, although modified by human interventions, maintains its natural, its 'unmade' qualities." Yet, it is still "an energy system." It is the interaction and the overlap that is most interesting.

Joel Tarr

Tue, 24 Jul 2001 17:56:08 +0200
From: travis travis@cc.huji.ac.il

Perhaps a footnote to the discussion of animals and technology, but the mention of horses is a reminder that Lederle Laboratories of Pearl River, New York, had a pet horse named Jumbo. Over a ten year period he had given over 450 gallons of blood used in making pneumonia and tetanus antitoxins. No doubt it was his cuteness that extended life beyond retirement. Jumbo died in 1944. He was one of many horses bred for the purpose.

Tony Travis

Tue, 24 Jul 2001 12:28:33 -0400
From: Erik Peter Rau erau@udel.edu

Martin makes a good cautionary point, which leads us to the good old "what is technology" question that most of us foist on our own students. Is a source of power or labor always a technology, or only when it is inanimate--as Jan Wegner points suggests? I'm reminded of Robert Kohler's book on the drosophila fly, _Lords of the Fly_, which argues that the fly itself is the critical piece of laboratory technology in early genetic research (not simply the result of technological application), selectively bred to be carbon copies of one another, and thereby eliminating variability in tests and experiments.

Context and perspective undoubtedly matters. To Marty's engineers, it's the levees that count as technology, not the river (the object to be controlled). But to many generations of riverboat men, the river itself is what counts. What's unclear to me is whether they would've thought of the river in mechanical terms or as something else. Their own accounts, and those of their contemporaries, can clear this up.

Why insist on an immutable definition of technology? Better to let our subjects tell us how they understand the issue, and learn from them.

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Tue, 24 Jul 2001 13:17:49 -0400
From: "Reuss, Martin A HQ02" Martin.A.Reuss@HQ02.USACE.ARMY.MIL

A quick response to Joel's observation in reply to my message. There is an enormous difference between using the term "machine" as metaphor and actually considering an animal as "technology". One might argue that White does, in fact, mean the Columbia River to be literally an "organic machine" but, as the quotation that Joel uses clearly indicates, the "organic machine" has more similarity with Odom's idea of ecosystem as an energy flow than with the mechanical world of energy production and distribution--despite whatever human constraints have been put on the river.

Marty Reuss

Tue, 24 Jul 2001 13:32:43 -0400 (EDT)
From: tzeller@sas.upenn.edu (Thomas Zeller)

I understood Ed's initial question as a rhetorical device to start the discussion, in which he has succeeded. Another very useful historical account of the intersections between (human) bodies and machines is Anson Rabinbach's "The Human Motor: Energy, Fatigue, and the Origins of Modernity." It historicizes the question magisterially.

Thomas Zeller
Oakland University

Tue, 24 Jul 2001 15:44:41 -0700
From: Christine Rosen crosen@haas.berkeley.edu

This is a really interesting discussion. One way to think about the question of whether animals are technology is to ask the question whether humans are technology. Are we? Would a cloned person be a form of technology? Someone with an artificial heart? A child conceived to provide bone marrow for a sibling? We all perform tasks, use energy, emit wastes, are composed of parts linked by electrical connections etc.

Most readers would probably gasp at the idea of defining people as a form of technology -- just as some would never dream of defining a river, even one firmly held in by levees, as a piece of technology. Yet we all respond to the image of Charlie Chaplin going nuts on the assembly line in (I think) Modern Times and the point he was making about humans as an extension of technology. Of course the point there was that we were supposed to be horrified at the thought. There is an article in today's Wall Street Journal about assembly line workers who are now being asked to work 12-hour shifts at varying times so that companies can keep their factories running 24/7. They don't like feeling like they are being treated like machines. And of course, in very profound way, they are not factory machines. They are people with relatives, friends, bosses, problems, hopes dreams etc. But they may be performing the tasks of machines and being treated as such. What about people who are working very hard to achieve goals like advancing medical science or computer design -- because they love this and make a lot of money at it -- or just at body building or painting or making music. Does this activity make them technology?

Maybe it would be useful to try to answer this question of about whether living things are technology to talk in terms of tensions between different ways of looking at life and technology. We could analyze the tension that exists between how we define life -- human life and animal life (maybe not plant life?) - the ideals and images we attribute to the idea of human life in particular which are expressed in terms so unlike the way we describe machinery (at least till we get to the cellular level) ---and how we treat life and use it and manipulate it.   And juxtapose this with what we know about how bodies function at the organic level, where the chemical and electrical reactions are incredibly sophisticated and serve as models for scientists and designers in high tech industries   who seek to use nature as a model for new technologies (touted by some of us in the green management field as "eco" or "bio" "mimicry" and as part of the solution to the world's environmental problems).   Why is the tension upsetting in some contexts and not in others? Has this changed over time?   Is there something more upsetting about genetic manipulation of species (and people) than traditional animal husbandry and plant breeding or putting a person (or an animal) in a factory and ruthlessly exploiting him/her. If so, what? Would the handloom weavers of early modern England have agreed?

The obverse question, of course, will we create machines that are "human" enough qualities to deserve some or all human rights etc.

Chris Rosen

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Wed, 25 Jul 2001 14:08:23 -0400
From: "Clay Mcshane" c.mcshane@neu.edu

Christine Rosen asks good and hard questions about which we have three comments.

The most obvious example of manipulating humans like machines is probably in slave societies. Castration was probably used on humans long before animals. I believe that some slave societies also tried selective breeding. Certainly their owners commodified slaves, valuing them purely for their work. Still slave systems, even in the U.S., had some provision for manumission. We must confess that we are hardly experts on this contested terrain, but the cultural definition of slaves varied widely over time and from culture to culture.

Perhaps the best example of humans as technologies is the organization of groups of people into bureaucracies, as Rosenberg points out with her discussion of assembly lines.. Bureaus were machines in the traditional sense of the word, since they had moving parts. If we recall, Jacques Ellul has a long discussion of this in _The Technological Society_. We think Rosen is right when she defines assembly line workers as being machines in one, but not most contexts.

There is also an intermediary category--the cyborg, which is both an animal and a technology. Certainly nineteenth century draft animals fit this category. There is a kind of vagueness and relativism in the definition of cyborg though. I would not define a human with a pacemaker as a technology. On the other hand, a Schwarzeneggerian cyborg, a golem or a Frankenstein clearly is.

Clay McShane
Joel Tarr

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Wed, 25 Jul 2001 15:34:06 -0400
From: "Reuss, Martin A HQ02" Martin.A.Reuss@HQ02.USACE.ARMY.MIL

If I twist wire into a form of a woman, is it a woman? If I drive a car along the Washington beltway and feel like a helpless cog, am I a machine? If I paint a picture of a mountain, is it a mountain? I ask these questions because I am surprised at the severe functional definition Clay and Joel apparently use to identify "machines." Is what the artifact does, or was created to do, the only criterion necessary to declare it a machine or not? If so, probably everything is a machine in some way or other. This makes neither semantic nor logical sense. An appeal to Aristotle or Plato may be appropriate here, but that requires a book.

Surely, though, we can concede that to be treated like a machine is not the same as being a machine. To even suggest such an idea insults slaves, holocaust survivors, and many, many others. I do not believe Joel and Clay meant this, but even implying the point disturbs me. However, to make myself perfectly clear, it also insults the guy stuck on the beltway, assembly line workers, and other social "cogs". Yes, we may be treated like machines and, yes, within our communities and certainly within the institutions we work we are a "system" that mimics in some ways the assembly line (oh, if only the federal bureaucracy was that good!), but we are not "technologies".

Something perhaps needs to be said on behalf of an old-fashioned idea: machines are human inventions devised to extend human power. Must we insist that other parts of the physical universe, sentient or not, are machines by virtue of function alone? I think not. This carries metaphor too far and ignores the very qualities that give the universe variety and meaning.

Marty Reuss

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Wed, 25 Jul 2001 17:15:55 -0400
From: "Clay Mcshane" c.mcshane@neu.edu

Before domestication (at least six millennia ago) male horses weighed 600 pounds (perhaps less) had feet too tender for anything but a prairie, panicked when they saw something out of the corner of their eyes occupied narrow territories exclusively, bonded to a stallion who had established his dominance through success at violent conflict, and engaged in frequent, often violent mating behaviors. They certainly had no interest in following the commands of humans.

It was humans, not nature that created 2000 pound, iron shod, docile, blindered animals with no interest in sex and the attendant violence that existed in 1900. Technically the same species yes, but qualitatively so different as to be described as the product of humans.

The differences with nature are even more obvious with mules, who would not even exist without human intervention.

Slipping the phrase "holocaust survivors" into Reuss' response is really unfair argumentation.

I believe that both Joel and Marty have left or are about to leave for a conference in Bergen. May I suggest resuming the fun at that point, after an adjournment?

Clay McShane

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Wed, 25 Jul 2001 21:47:52 -0700
From: "Clay Mcshane" c.mcshane@neu.edu

I think this only confirms our point. Stallions sought to bond with mares. Reducing that drive by gelding made it easier focus bonding instincts on members of other species.   Stable owners

were very careful to keep a horse with the same teamster figuring that horses would follow a human leader as they followed the herd leader in nature.   On a crowded city street acknowledging only one voice obviously improved safety. Reducing "stallion behavior," such as fighting for leadership was exactly the point.

Incidentally the bonding seems to have worked both ways--striking teamsters allowed hay wagons past their lines. When they seized strikebreaker's vehicles to set up barricades, horses were always led back to the stable.

Clay McShane

Wed, 25 Jul 2001 21:47:53 -0700
From: MAURA.MACKOWSKI@asu.edu [mailto:MAURA.MACKOWSKI@asu.edu]

Perhaps some of you have received the same thing in the mail today that I did; a small book called "Fall 2001 Science Sampler" from Houghton Mifflin. It has excerpts from four of their new books, and one seems to be addressing the question originally posted, about genetic engineering in the past. It's called "Shrinking the Cat: Genetic Engineering before we Knew About Genes" by Sue Hubbell. The one chapter that's included seems to be much broader than cats, because it refers to how corn became something other than a very large grass, attempts to get rid of corn borers and a few other things. I'm not a genetic engineering historian, but it seems to be using the same approach that the original message in this thread was asking about.

Maura Mackowski
Arizona State University

Thu, 26 Jul 2001 11:26:31 -0400
From: "Cayford, Jerry" Cayford@rff.org

There have been many interesting comments on this question, but some of them seem too sophisticated. Neither animals nor people nor anything else is one thing only. If I am running to catch a bus, the pedestrians on the sidewalk are obstacles, just as much as telephone poles, newspaper boxes and bike racks are. That doesn't mean they aren't also people. As I run for the bus, I certainly (and properly) treat them as obstacles, but because they are also people I cannot treat them as cavalierly as I might treat non-people obstacles.

We are not going to find the "essence of technology" by peering closely at some examples. Nor by insisting that some one definition settles the issue. Our language and history are ambiguous, perhaps because how we should act (and what things are) depends on the circumstances, not on definitions. "A person is not a machine" is no more a truth claim than is "A woman is not an object". Both are reminders of moral obligations in dealing with people. Saying that animals (or rivers, or people) are technologies is not a shortcut past all the moral issues. The question is whether that is a useful, illuminating way to speak. I think this discussion has brought up lots of circumstances when it is. If it is also a dangerous way to speak, then we must deal with that, but not by pretending that it is false.

Jerry Cayford
Resources for the Future

Thu, 26 Jul 2001 12:50:32 -0400
From: "Brock, David" davidb@chemheritage.org

I have been following the exchange on this topic with great interest.

Please forgive me if my suggestions below have been raised already.

It would seem to me that the notion of the cyborg, as articulated by Donna Haraway (see her book, 'Simians, Cyborgs, and Women' in particular—though the notion of the cyborg is a returning motif throughout her work) and others, is of some moment here. This notion of the cyborg--a hybrid of technology and an organism--speaks to many of the instances we have been discussing in which the lines between the animal and the technological blur.

More broadly, it seems to me that it is the concept of the hybrid, of the made and the unmade, that gets some purchase on this issue. The river with its levees is a hybrid of the made and unmade, so too a genetically modified organism. The concept of the hybrid may also help us to unpack the related topic of the connection of human and non-human animals to machines— perhaps hybrid systems?

Lastly, the many comments on the occasions wherein human and non-human animals were seemingly used as technologies prompted this thought: these appear to be instances wherein the behavior, practices, and even characteristics of human and non-human animals were disciplined in order to made them as much like those of a machine as possible.

Thanks again for the discussion.

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Thu, 26 Jul 2001 19:40:11 +0200
From: Herbert Mehrtens h.mehrtens@tu-bs.de

Dear list, this is a highly interesting thread that I found returning home.
Working on the introduction of "scientific management" in the early twentieth century, I had to ask myself what and how I should describe the system of machines, humans, communications all organized and reshaped to attain efficiency. Is it technology?

As a historian, I need two concepts of "technology", one is that of the contemporaries.

F.W: Taylor and his companions would have said that technology is machines. But they were looking for the "one best way" - in the case of human workers for the right "technique" to do things efficiently.

The other concept I need is that which I use for the analytical description of my historical subject. And here I find it inevitable to speak of a "technification" of humans and of means of communication as part of the organizational technification of the industrial enterprise as a system. If I learn to drive a car I have to "technify" myself to fulfill functions in the human-machine interaction reliably and repeatably without needing to think about it. But that does not mean that I AM technology.

The question "IS my dog technology" opens the ontological trap. What does the "is" mean?

Is the machine in a museum technology, or is it a showpiece? It certainly is an assemblage of technified physical matter, but it does not work, and it does possibly not even matter whether it could work.

Technology as "machine" is 19th century thinking. Early 21st century has to take the technification of human and other living bodies into account, and it has to recognize that technology works usually only when living bodies, symbolic forms of communication and physical matter are technified simultaneously.

Thus "technology" is the form you give something in order to make it function for some purpose - fairly well controlled, fairly reliably, and fairly well repeatable. As a "form" and a set of relations it is an aspect of things, no more.

The only English language paper I know which explicates this concept of "technology" is: Werner Rammert: New Rules of Sociological Method: Rethinking Technology Studies, British Journal of Sociology 48 (1997), 171-191. Rammert, however, does not seem to care much for dogs. He has no discussion of living bodies other than humans and lacks terminology for this case. In any case, animals can be technified in genotype as well as in phenotype.

But they are clearly not "technology". The dachshunds I know are no functional technology, although their bodies tell of technification.

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Thu, 26 Jul 2001 14:23:00 –0400
From: Paul Israel pisrael@rci.rutgers.edu

Like everyone else I've been fascinated by the discussion of this topic. The issues it raises are very broad and deep. I'm just beginning a project now that is somewhat related. I'm interested in exploring through changes in the patent system how definitions of technology qua technology and as a particular kind of intellectual property have changed over time. This was prompted, in part, by current debates over the patenting of organic materials such as seeds and genes. The patenting of seeds and plant hybrids is very recent and until about a decade was not done. It is my understanding that seeds had been specifically excluded from the patent system by a 1920s law.

Part of the envirotech discussion--Marty Reuss's contributions come most readily to mind--has focused on the idea of technology as machines, thus excluding animals. Yet, I would argue that this is a very old and no longer current definition of technology. Certainly the patent system at various points has been adapted to different definitions of technology that include chemical combinations as well as the processes for producing them and more recently various kinds of

organic materials and software code, which may operate machines but are not themselves machines. Most people would be comfortable, however, seeing software as a form of technology.

So I'm delighted by this discussion, which has certainly been useful for me in beginning to frame this project.

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Thu, 26 Jul 2001 14:30:35 -0400
From: "Clay Mcshane" c.mcshane@neu.edu

In Cayford's vein, I've been trying to think about language. . What's a technology? Many participants in this debate, myself included at times, have been equating technology and machines. This won't do, although clearly machines are technologies. For one thing materials, say nylon or horseshoes, are technologies. For another large technical systems, say a electrical grid, which is made up of machines, materials (like copper and rubber), and bureaucracies (mostly human), are technologies. My dictionary describes it as "the practical application of knowledge." _Roget's Thesaurus_ equates technology to "skill."

Large nineteenth century draft animals (and herding dogs and small cats and oversized chickens) were all part of a practical application of knowledge to make them more like machines, which is not the same as saying that they were machines. Certainly this is true when equids are viewed as part of a larger system including harnessing devices, vehicles, housing, drivers, feeding system and work. None of this is to claim that technological process was good or that the animals don't remain sentient or have biological origins, rather the point is about human manipulation, just as it is for rocks. Once again, mules, provide an even better example, they aren't even a species in the ordinary sense, since they can't reproduce, although, to be sure, they're sentient.

The NASA scientist Manfred E. Clynes coined the word cyborg in 1960 to describe a laboratory rat with a pump permanently attached (actually it seems to have been a self-regulating animal-machine organism--the two were inseparable). I believe that Clynes thought that humans would have to be modified mechanically for space travel. Like David Brock, I think we might be better to use the word cyborg (meaning a technology, the application of human skill, but not a machine).

Thu, 26 Jul 2001 13:59:09 –0500
From: "Mallea, Amahia K (UMC-Student)" akmbb1@mizzou.edu

I find this quote helpful:
Technology is "the point of interaction between the human and the natural." Arthur McEvoy as quoted in Stine and Tarr, "At the Intersection of Histories: TEchnology and the Environment," _Technology and Culture_ 39 (Oct. 1998), 604.

Thu, 26 Jul 2001 14:28:25 -0500
From: Jonathan Coopersmith j-coopersmith@tamu.edu

Possibly paraphrasing Paul, if you can patent it, it's a technology?

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Thu, 26 Jul 2001 22:51:30 +0200
From: Herbert Mehrtens h.mehrtens@tu-bs.de

The postings that came together with mine are the reason to add a few remarks: Amalia Mallea makes a point in defining technology quoting "the point of interaction between the human and the natural" -- When I learn to drive a car and routinize (technify) certain forms of interaction with the machine - what do I interact with (besides the elements of the car like the wheel, the clutch.)? Is it that what is "natural" in me? Or is it my human condition?

Does this question not point to the problems in keeping a concept of technology that holds up an essential opposition between human (or sentient) and technology (or technical) ?

To propose the "cyborg" (Clay Mcshane) is in the same vein. It is a matter of language, and we do need a way to talk about technifying the world that takes the changes in patent practices into account (Jonathan Coppersmith). What you can patent is potentially good for making money. For the patent it has to be new, but also has to promise something you can sell because it functions to some end reliably and repeatable. The latter is my minimal definition of "what is technological" (Das Technische). I can do it to some extent in German, but I would be glad to find the English words (and better German ones) to express that "The Technological" is not essence, not thing, not value, but forms and relations and hybrids. As it has been done in this discussion, we should then also talk about the valuations involved.

Thanks,

Herbert Mehrtens

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Thu, 26 Jul 2001 15:43:55
From: "Betsy Mendelsohn" b_mendelsohn@hotmail.com

Hi Envirotech,

I've been enjoying Ed Russell's thread a lot; it seems to have drawn out people from all over the place.

A couple things have come up for me about animals and technology, specifically the use of dogs in highly technological settings. Dogs are used by people in these settings because their physiology and size is close to human and because their noses and ears are more perceptive.

The applications I'm thinking of are dogs used in experiments for space flight (and the dog the USSR left in orbit) and in other medical experiments and the dogs used by the US military in the 20th century as message-bearers, bomb-sniffers, and ambush sensors. While as I recall certain breeds are/were favored in these uses, the animals aren't actually bred for the purpose. It's their essentially organic, animal nature, including their bonding with handlers in the military uses, that makes them valuable.

I suppose if one looks at experimental medicine and space flight as a whole over the last few centuries, then animals become embedded in a matrix of experiments, safety protocols, funding programs, and institutional agendas, as little essential parts of a huge modern machine. Perhaps when one generalizes at that scale (or at the scale of 120,000 horses and horsepower in a city) it is useful to conceive of the animals for simply their utilitarian aspects.

I value the categorical distinction between animals and technology; I suppose part of that's emotional. I know that when people use animals as if they are non-sentient it seems inhumane -- factory farming and abandoning the dog in orbit disturb me. Some of the appeal of the categorical distinction, however, is intellectual, or based on definitions of what animals and technology are. As Marty Reuss said, we can manipulate animals genetically and physically by huge amounts, but they're still categorically animals with a unique genetic origin, in many cases sentience, and certainly a genetic code with a will of its own. Manipulating an animal is essentially different from beating a piece of cast iron into a Japanese sword.

Also, in keeping the categories, that is to say by referring to 120,000 horses rather than to X amount of horsepower, we're reminded that behind the power is a whole lot of unique and autonomous animals, just like behind "the labor force" are millions of individual people working away. In the case of using animals in heavily technological systems, retaining the category "animal" means that the moral dilemmas of people involving animals in such systems are always present.

I don't think animals are technology, even microscopic animals where I don't feel any moral dilemma about their use (despite Horton Hears a Hoo). If something's got DNA (or RNA), then it has an origin and program for its life and death that precede human art. Perhaps this shows the influence of process theology on my thinking? Probably not. I think it's because I grew up with dogs.

Go, Ed!, for exploring these questions about animals and technology.

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Thu, 26 Jul 2001 18:50:39 –0400
From: "John Staudenmaier" staudejm@udmercy.edu

Like a zillion others, I've been following this conversation. Stimulating and then some. My specially created mailbox now numbers almost 40 postings.

Here's another two cents worth. I find it helpful to use a broad definition of technology as an attempt to organize some elements of reality for some humanly defined purpose, purposeful

activity via some kind of creative construction (material or conceptual).   And what makes this discussion so interesting, and probably gives it the energy that stirs so many postings, is the encounter (violent or not violent, a meeting of other with other) of human purpose with that which has not originated from some human's (humans') purposeful intent.

When a human works to train an animal, isn't it the tension between that which humans plan and try to execute (and try to predict and use etc.) with what operates according to some other pattern, isn't that what makes this animal question so interesting? Ditto biogenetics.

The energy in this purpose/non-purpose (planned/not-planned) encounter may be also what makes sports exciting to many people precisely because one does not know the outcome in advance. There's a freshness about that which cannot be predicted (hence the outrage at fixing a game to render it purposeful in advance). True, sports events are managed like crazy (esp. to look for ratings gains) but if the purposeful and managed were to triumph completely over the unpredictable, wouldn't sport lose its lustre?

john sj

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Thu, 26 Jul 2001 16:30:02 –0700
From: jcw1 jcw1@gateway.net

In an earlier posting, Amahia K. Mallea mentioned Arthur McEvoy's statement that technology is "the point of interaction between the human and the natural." My work of late is focused on that idea. See James C. Williams, "The Technology Junction: Exploring Technology and the Environment," ICON: The Journal of the International Committee for the History of Technology, 6 (2000), which I am told has finally found its way out of the print shop and is "in the mail." For information about ICON and ICOHTEC, surf your way to the ICOHTEC web site: <http://www.icohtec.org>.

Jim Williams

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Fri, 27 Jul 2001 15:23:45 +1000
From: Jan Wegner janice.wegner@jcu.edu.au

To muddy the waters even further:
Some of the discussion is saying that animals were bred to be more like machines, yet the very societies that were doing this were much more reliant on animals (including humans) than machines, which were slowly being developed to replace or extend animal/human power and abilities. They might rather say they were developing machines to be more like super-animals or super-humans, (eg steam engine, spinning jenny) or to increase the capabilities of animals and humans (eg a cart and harness + necessary training increases the capacity of a horse to transport goods, a stirrup and the new riding techniques that went with it allowed the rider to do more in the saddle). I don't think they would recognize the metaphor of animal-like-machine, despite Descartes and 17th century mechanical explanations of biology. In fact it seems to be the 20th century that sees (and treats) animals like machines (battery hens, feed lot cattle).

So up until the late 20th century, is it more appropriate to talk about animals from a human perspective as environmental modifications (ie something broader than technology)? Or can environmental modifications by humans all be counted as technology? Or are we talking about _applications_ of technology (breeding techniques, training techniques) which brings me back to my original thought that the technology is in the relationship between animal and human?

Jan Wegner
James Cook University

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Fri, 27 Jul 2001 15:17:53 +0900
From: "Barbara Sugihara" yamanba@par.odn.ne.jp

This discussion seems to be focusing on technology as 1) either the physical outcome of a process through which humans have made systematic use of tools to alter something to serve human purpose; 2) the tools themselves; or 3) animate agents who manipulate tools toward a desired outcome.

What about a systematic group of skills as technology?

In the case of the premodern crafts I am studying, such as thatching, tools are rarely (and only in recent times) mechanical, usually very simple, and frequently hand-made. Are these, in and of themselves, technology vis-à-vis the roof?

Is the physical outcome--in this case, the roof--in and of itself technology? Or is the craftsman per se technology? (Although if you allow that a tool is technology, then the hand that wields the tool or performs a mechanical task might, I suppose, also be considered technology.) Is it not the knowledge that, for example, a given type of grass (water reed or whatever) laid and fastened in a particular way will result in a durable roof under a given set of physical conditions (and the intuitive capacity to make minute adjustments in the elements of construction to suit the immediate environment), coupled with the actual ability to lay the grass and affix it properly, that constitutes a technology?

And what about the social system that enables this group of skills to be applied effectively? Should rules of community cooperation for thatching be considered technology? Or the mores that enable a group of craftsmen to work together on a job? Or, in modern contexts, the rules and social structure of the workplace?

Throughout this discussion thus far, the term "technology" has been used to cover wide variety of phenomena, but to me it seems that the nucleus of its meaning is getting lost in the shuffle.

Barbara Sugihara
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Fri, 27 Jul 2001 07:24:04 –0400
From: "Reuss, Martin A HQ02" Martin.A.Reuss@HQ02.USACE.ARMY.MIL

Like everyone else, I am fascinated by the correspondence generated by Ed Russell's original question: Are animals technology? A major aspect of the discussion that I believe bears further exploration is the issue of definition. I am familiar with all or most of the definitions that have been advanced for "technology," and I have a level of discomfort with all of them I suppose. That is why, in some frustration, I retreated to an old-fashioned definition that, as Paul Israel remarked, is no longer currently accepted. Similarly, the notion of "machine," however defined, rarely entirely fits the circumstance at hand.

Now it seems to me--and the correspondence supports the observation—that this discussion group has a unique contribution to make. Transcending as it does the worlds of environmental

and technological history, cannot we sponsor some sort of panel discussion on the subject at both the SHOT and ASEH conferences. I think such panel discussions might be stimulating and might even lead to some worthy publications. I know this is searching through old bones, but perhaps it is time to open the closet again. An age of AI, biogenetics, etc. compels some new thinking. Incidentally, I suggest that these panels include other disciplines besides history. Any thoughts on the matter?

Marty Reuss

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Fri, 27 Jul 2001 11:15:46 -0700
From: jcw1 <jcw1@gateway.net>

I should like to endorse Marty Reuss's suggestion that Envirotech sponsor a panel session at ASEH and/or SHOT in 2002 related to the topic of this discussion. As a matter of mechanics, because Envirotech is an official special interest group (SIG) of SHOT, we are entitled to organize a session at each annual meeting. Might I suggest further that Ed Russell and Marty Reuss organize such a session for either or both conferences? I'm sure that my Envirotech co-chair would endorse this.

Speaking of these annual meetings, I hope as many of you as possible will be at the SHOT meeting in San Jose (Silicon Valley) this October. Envirotech has a luncheon meeting at the Gordon Biersch Brewery, which should be great fun and good beer.

Jim Williams

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Sun, 29 Jul 2001 10:00:22 -0400 (EDT)
From: angreene@sas.upenn.edu (Ann Greene)

I am extremely interested in the current discussion on animals and technology, since I am writing my dissertation on horses as a power technology in the 19th century United States. The discussion began while I was out of town, and I am still digesting and pondering people's contributions, but my immediate comment is to reply to the interest in having a panel by noting that I am giving a paper on this topic at SHOT this fall, and that Ed Russell, Laurie Anderson and I have proposed a panel on this topic for ASEH 2002.

Ann Greene
University of Pennsylvania

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Tue, 31 Jul 2001
From: pjk23@hermes.cam.ac.uk (Paul Kirby)

A land-yacht, as you probably know, sails along dry land powered by the wind. The land yacht is clearly part of technology. It is powered by the wind, but the wind is not a part of a useful definition of technology. If the wind is included what can be omitted? If nothing can be omitted, all the universe is technology and the term loses any meaning.

If we replace the wind, as a motive force, by a dog pulling the yacht we enter trickier ground. If it is a wild dog (a dingo perhaps) which is untrained and which pulls the yacht out of a desire to flee its bizarre experimenters then it is acting like the wind. A natural force following a pattern of behavior, which is channeled by but not formed by humankind. Similarly it is therefore not technology (but is exploited by technology.)

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If we re-capture our dingo and train its offspring to pull the yacht under voice command has it become technology yet?

If we selectively breed our dingo for more (suitably) powerful legs and no teeth (say). What then?

If by increasingly perverse selective breeding and biotechnology we are left with canine leg muscles, reproductive organs and an electronics interface then what?

To some degree I am not sure whether it is important to decide where along this continuum the line is drawn. (If it is drawn at all.) Except that asking the question does help us, perhaps, agree a definition of technology. The question concerns not the attributes of animals that make them technology but the definition of technology that may or may not include animals.

For me the line is drawn at the point where the object (the dog say) is "prepared" for use by the technology. If a natural phenomenon can exist irrespective of its potential for use in technology (the wind, the wild dog etc) then (for me) it is not part of technology. If however its condition is the product of actions that render it useful, then it is part of technology. The trained dog for example.

So far so good, but we could challenge the definition by asking what happens if we channel the wind so that it strikes our sails more efficiently. In this case it may be that "its condition is the product of actions that render it useful" and the wind is therefore within our definition of technology. Oops. We can escape by saying the device that does the channeling acts on the non-technological wind and we could thus preserving the wind outside of technology. The wind that is channeled however now becomes part of technology. So it is with the dog. An untrained dog is not part of technology but a trained one is. Preparation for use (not use itself) is (for meanyway) the critical threshold.

But then, I am not a philosopher.

Kind regards
Paul Kirby
Interdisciplinary Design for The Built Environment
Cambridge University

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Tue, 31 Jul 2001 18:00:32 -0400
From: "Cayford, Jerry" Cayford@rff.org

I am bothered by the reasoning, several times repeated, that a word must include some things and exclude others to be meaningful. (e.g.: "If nothing can be omitted, all the universe is technology and the term loses any meaning.") This seems false to me. Consider the word "useful". Is there anything that is simply excluded by this word? Doesn't everything have uses in some context or to some agent? But that doesn't make the word "useful" meaningless. Or consider "in motion". It is an ancient and still valid observation that everything is in motion all the time, just some things are slower than others. This doesn't make the concept meaningless.

I suggest that "technology" usually refers to systems, many parts (ultimately all parts?) of which are naturally occurring and would not, in isolation from the system, be considered technologies. Not only wind and wild dogs, but the explosion of gases in an engine, or the desire of fluids to

enter a vacuum, all are natural phenomena. Being part of a technology does not make the parts themselves "technologies", but neither does their naturalness make them any less "part of a technology". The answer to what we call a "technology" is not in the properties of things but in the uses to which we put them and the control we exercise.

Jerry Cayford
Resources for the Future

Tue, 31 Jul 2001 16:09:51 -0700
From: James Williams techjunc@pacbell.net

Off the list, Marty Reuss suggested to me that it might be constructive to ask the question another way: not how are animals like technology but how much is technology like animals? He comment reminds of Steven Vogel's _Cats' Paws and Catapults: Mechanical Worlds of Nature and People_ (NY: W.W. Norton, 1998)? He's a biologist at Duke who addresses your question in a sense, by asking how much is technology like nature--seashells, spider webs, birds' wings, and so forth. I've got it, it looks intriguing, but must admit I've not read it. Maybe now's the time.

Jim Williams
New email: techjunc@pacbell.net

Wed, 01 Aug 2001 10:55:07 -0400
From: Kent Curtis kentalexandercurtis@hotmail.com

>Re: how much is technology like animals?

Along these lines, there is a growing body of thinking suggesting that the further a technology deviates from natural systems (animals being only one), the less sustainable it is -- and, by extension, the less desirable it is. See, for example, Janine Benyus, _Biomimicry: Innovation Inspired by Nature_ (NY: William Morrow, 1997). Benyus explores the work of dozens of researchers who are seeking ways to absorb the lessons of millions of years of natural evolution into future technical development -- perennial polyculture farming, photosynthetic energy processes, and neuron-styled computation, for example -- all of which combine complexity, efficiency, and regenerative qualities. She suggests that there is nothing human beings have invented that does not have a natural predecessor, and one that is usually more effective at its task, more complex in its abilities, and less erosive to earthly habitat. From this perspective, the answer to the original question might be, yes, some animals are technology, shame on us.

K. Curtis

Tue, 31 Jul 2001 14:15:31 EDT
From: Sara Pritchard SbpLyon@aol.com

I returned from vacation to happily find my email in-box inundated with fascinating and stimulating comments from Ed Russell's original post (thanks again to Ed for sparking such a lively and thought-provoking conversation...).

I will succumb to raising more questions and thoughts than cohesive responses:

- Art McEvoy argued for framing the human body as 'nature' or 'what was natural' in the technological system of the factory in an article in T&C several years ago. Does his essay on human-as-nature-too help our conversation at all?

- Can the question 'are animals technology?' be rewritten to be the more inclusive 'is nature technology, too?' If so, where does this lead us?

- Picking up on several exchanges over the proverbial 'what is technology?' question: if we ascribe to a post-Hughesian and/or Latourian definition of technology that emphasizes the notion of systems (to include knowledge, skill sets, and different groups of people in addition to 'artifacts' and white male engineers, as several people pointed out), does nature fit into this definition of technology, acknowledging Erik Rau's valid reminder that we need to historicize definitions, actors, and our own debates about these questions?

- Marty Reuss argues that technology is not the leveed river, but the levees (and perhaps he would agree the larger technological system in which they are embedded). It seems to me that the fundamental question in dog-breeding or dammed rivers is **where does technology end and nature begin?** The hydroelectric dams on the Rhone River that I study both transform and are dependent upon the various environmental forces at work in the watershed of the Rhone valley. Is the metal turbine 'technology' while the water flowing through that turbine 'nature'? Or is it more complicated?

- Finally, to revive a question that emerged from a panel at the ASEH conference last March, do theoretical notions of hybridity (e.g., the hydroelectric projects of the Rhone River at the intersection of technology and ecological systems) illuminate more than simplistic dualisms? Or do they somehow lead us to a murky analytic state? Does Rau's call for historicism allow us to elude a hybrid morass?

Sara

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Wed, 01 Aug 2001 15:30:13 -0400
From: John Staudenmaier <staudejm@udmercy.edu>

> Re: Janine Benyus, _Biomimicry: Innovation Inspired by Nature_ (NY: William Morrow, 1997).

This reminds me of the contrast between 19th century (and prior) cities and classic 20th century cities, at least in the U.S. Pre-20th century cities all locate near abundant fresh water and a lot of U.S. cities that have flourished in the 20th C (LA, Phoenix come immediately to mind) use energy driving water pumping systems + air conditioners to trump eco constraints.

Are you as struck as I by the wave of thinking that suggests a 21st century geographical pattern more like the 19th than the 20th? I've been struck, too, by the many ways the Bush administration appears to be trying to reinvigorate 20th century use patterns, even heard a suggestion last week that G W wants to talk w. Canadians about piping great lakes water down to the southwest US.

In short, it's a pretty interesting time for eco and geographical thinking.

john st sj

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